

## 43. Nematodes

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### Hosts

Seedlings of all tree species are susceptible, at least to some degree, to plant-parasitic nematodes. The nematodes most damaging in forest nurseries include root-knot nematodes, *Meloidogyne* spp.; pine cystoid nematodes, *Meloidodera* spp.; lance nematodes, *Hoplolaimus* spp.; lesion nematodes, *Pratylenchus* spp.; stunt nematodes, *Tylenchorhynchus* spp.; stubby-root nematodes, *Trichodorus* spp.; and dagger nematodes, *Xiphinema* spp. Some parasitic nematodes have a wide host range, feeding on many different forest tree species. Others have more restricted feeding habits.

### Distribution

Plant-parasitic nematodes occur in forest nurseries throughout the United States. Because cool temperatures are unfavorable to most species, root-knot nematodes are not important parasites in the Northern States. Conversely, certain pathogenic species of lesion nematodes—effective pathogens in colder regions—are rarely found in southern nurseries.

### Damage

Nematodes seldom kill seedlings outright. They may, however, severely debilitate the plant through partial destruction of the root system. Wounds caused by nematode attack may serve as points of entrance for root pathogens such as *Fusarium* spp. The resulting disease complex may then cause significant mortality.

### Diagnosis

Nematode diseases ordinarily cannot be diagnosed solely by their symptoms, which are indicative of a poorly functioning root system. Other parasitic organisms and certain environmental factors produce similar symptoms. The reaction of plants to attack by plant-parasitic nematodes varies considerably with the host-parasite combination.

Diseased seedlings are stunted (fig. 43-1), and their foliage is reduced in size and becomes chlorotic (fig. 43-2). They often show symptoms of nutrient deficiency, even when high levels of soil fertility are maintained. Affected plants lack vigor and usually cannot withstand extended periods of soil moisture stress.

The underground root symptoms vary with the nematode species. Root-knot nematodes may cause galls on the roots (fig. 43-3) and,



**Figure 43-1**—Pine seedling on right was severely stunted by nematode attacks.



**Figure 43-2**—Chlorotic pine seedlings in beds heavily infested by nematodes. Beds at far left were fumigated with methyl bromide.



**Figure 43-3**—Slash pine seedlings (1-0) lifted from a Florida nursery show galls on their taproots caused by root-knot nematodes (*Meloidogyne* spp.).

roots near the galls. On certain hosts, dagger nematodes cause galls and bending of lateral roots. Pine cystoid nematodes cause few, if any, galls and are visible only when the swollen females erupt through the root epidermis. In contrast, lesion nematodes cause a necrosis of the cortex, which results in a general decay of the feeder roots. The lance nematode—an internal parasite particularly damaging to pine seedlings—also migrates through the cortical tissue and causes extensive internal cell destruction, which allows other pathogens to enter and further damage the root system.

Nematodes that do not enter the roots generally have less obvious effects on tree seedlings. Stunt, stubby-root, and dagger nematodes cause discoloration and surface lesions. The most frequent effect of their feeding is a general stunting of lateral roots without noticeable decay.

Nematodes are submicroscopic, slender, white worms. Specialized laboratory equipment is required to extract them from plants and soils. Identification to genus and species usually requires the services of a nematologist.

## Biology

All plant-parasitic nematodes have a stylet at their anterior end. They use this sharp-pointed tube to puncture plant cells and remove cellular contents. Some species feed internally in the feeder roots; others remain at the root surface and feed externally.

These feeding wounds provide entry points for other pathogens. The resulting disease complex may destroy more seedlings than a single pathogen acting alone.

## Control

**Cultural**—Crop rotation controls certain nematodes. In the rotation sequence, favor crops that are not susceptible. For example, where root-knot nematodes are a problem, rotation with fescue, a nonhost, is recommended over soybeans, a host.

**Chemical**—Fumigate the soil before seeding to control nematodes in forest nurseries. Methyl bromide is one of the most effective soil fumigants and provides excellent control in most nurseries. When nematodes are a problem in isolated nursery sections, spot injection with less volatile nematicides provides satisfactory control.

Dip roots of infected hardwoods in chemical solutions to control root-knot nematodes. A 15-minute dip in fen硫othion has been effective in protecting catalpa and dogwood. Immersing bare roots in hot water at 126 °F for 2 minutes has controlled lesion nematodes infecting eastern redcedar.

## Selected References

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